DOHERTY

The Development of the Construction of the Pianoforte in America

Music

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1915

THE DEVELOPMENT OF THE CONSTRUCTION OF THE PIANOFORTE IN AMERICA

BY

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THESIS

FOR THE

DEGREE OF BACHELOR OF MUSIC

SCHOOL OF MUSIC

UNIVERSITY OF ILLINOIS

1915

UNIVERSITY OF ILLINOIS

June 1, 1905.

THIS IS TO CERTIFY THAT THE THESIS PREPARED UNDER MY SUPERVISION BY

MARGARET ISABELLA DOHERTY,

ENTITLED THE DEVELOPMENT OF THE CONSTRUCTION OF THE

PIANOFORTE IN AMERICA.

IS APPROVED BY ME AS FULFILLING THIS PART OF THE REQUIREMENTS FOR THE

DEGREE OF BACHELOR OF MUSIC

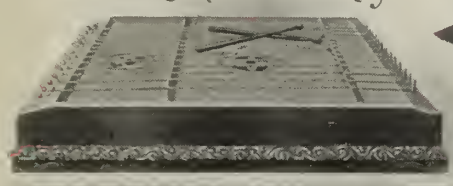
G. L. Schwartz
Instructor in Charge

APPROVED: Lawrence Erb

HEAD OF DEPARTMENT OF SCHOOL OF MUSIC.

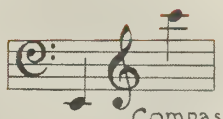
frontispiece.

Dulcimer or Psaltery

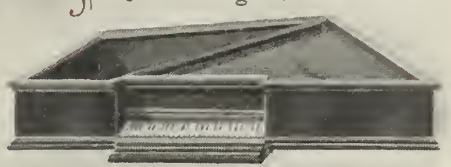


Action: Two hammers held in the hands

The First "Hammer" Action [Cristofori's]

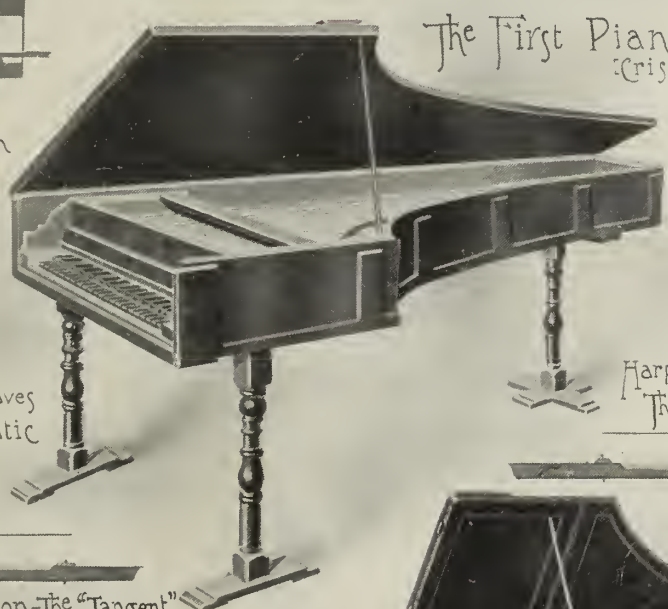


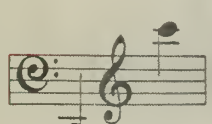
Spinet or Virginal



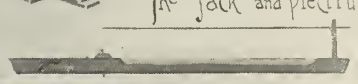
Action: same as Harpsichord (below)

The First Piano [Cristofori's]

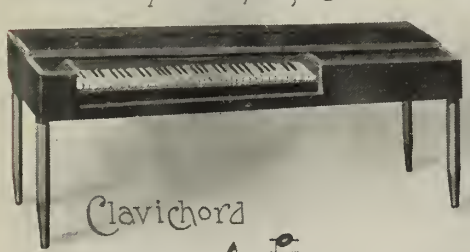




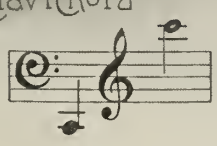
Harpsichord Action: The "jack" and plectrum



Clavichord Action - The "Tangent"



Clavichord



Harpsichord

From Kranich and Bach, Catalog.

CHAPTER I

Introduction

In order to understand more comprehensively and sympathetically the history of the American pianoforte, knowledge of the heritage bequeathed to the early American inventors is necessary. The precursors of the pianoforte divide themselves into four groups. The monochord, the first of this series, was an instrument used by Pythagoras (582 B.C.) for experiments in the mathematical relation of musical sounds. A single string, presumably catgut, was strung over a wooden box. Directly underneath the string a strip of paper was glued to the top of the box, on which the sections and subdivisions corresponding with the intervals of the scale were marked. The monochord came into universal use among the Greeks, and also in the Roman churches as an instrument to sound the keynote for chorus singing. To assure a quicker and more correct intonation, Guido D'Arrezzo (about 1100 A.D.) used a movable bridge under the string of the monochord. After this invention, further improvements came rapidly. The clavis or keys were applied to the monochord, which then was built with more than one string. Each clavis or key had a tangent or pricker. As soon as the clavis was pressed down, this tangent would prick the string on the proper divisions of the scale, and cause the sounding of the correct tone. The use of the clavis soon led to an increase in the number of strings, and during the twelfth and thirteenth centuries many ex-

periments were made to construct an instrument that would give all the notes of the scale correctly. These finally resulted in the invention of the clavicytherium. In this instrument, strings of catgut, arranged in the form of a triangle, were sounded by the pricking of quill plectra, fastened to the end of the clavis. It is believed that the clavicytherium was invented in Italy about 1300, and that it was later copied and improved by the Germans. The efforts to improve it finally developed the clavichord, which also was an Italian invention of the fourteenth century, subsequently copied by the Germans and Belgiums with modifications.[1]

The clavichord belongs to that genus of musical instruments termed clavier. The distinguishing characteristics of this genus are metal strings stretched across the sounding board and resting on a bridge in such a way that they can be set in motion by a series of levers called keys or ditigals. The latter are placed near the front, the actual key being pressed by the player on the balance rail. To the rear end of the key lever is fastened a stout perpendicular pin, flattened on top, or a wooden hopper carrying a quill at each end which plays easily on the strings.[2] By striking the key the quill is caused to twang the string, whereupon the hopper instantly falls back to its former position. To prevent vibration and consequently irritating the sounding of the shortest part agitated by the tangent, a narrow strip of cloth is interlaced be-

[1]Alfred Dolge, Pianos and their Makers, 27-29.

[2]C. F. Weitzmann, History of Pianoforte Playing and Pianoforte Literature, 216.

tween the strings. Most clavichords have two keys to each string; some three; while on the earlier clavichord there are two tangents fastened to one key. However, it was not until 1725 that a clavichord, constructed by Daniel Faber, a German, had a string for each note. The soundboard of the clavichord covers only half of the instrument; one side is left open so that these quills or the metallic tangents when the keys are pressed down can set in vibration the corresponding single or double or triple unisons. It was not until the eighteenth century that the strings were struck by hammers which were either fastened by the keys themselves or could play on spindles on a wooden rail above the keys or whose shanks were fastened by strips of parchment to the rail. The hammers were driven against the strings by a jack on a brass wire and instantly fell back after the key was struck into the former position by the aid of a spring hopper. For a long time the jack and the hopper have formed only one connected individual mechanism, the "action" of the pianoforte. When the key lever impels the hammer against the string, it also lifts from the latter its damper.

The clavichord is important in the development of the pianoforte because it possessed four of its vital points which are as follows: the independent sounding board; metal strings; the application of the damper; and the percussion method of agitating the strings.[1]

Of equal importance in the development of the modern pianoforte with the clavichord is the spinet or virginal, and harpsichord. About 1503, Giovani Spinnetti of Venice constructed an

[1]Dolge, Pianos and their Makers, 31.

oblong shaped instrument with a compass of four octaves. This oblong form enabled Spinnetti to use very long strings and a very large sounding board covering nearly the entire space, thus materially increasing the tone volume which however was still harsh, raw, and nasal. The spinet, as this invention of Spinnetti's was called contained one string only to each jack.[1]

The early harpsichord was in all its features, except the wing form, only an enlarged spinet. Later, in order to produce the desired tone color, the instrument was constructed with two, three, and sometimes four strings of different lengths, all about the same pitch which could be plucked together if desired, producing a great amount of power. These different strings had separate sets of jacks with their respective quills to pluck the string and could be manipulated by means of registers similar to the organ either singly or together.[2] The stops on the harpsichord which had permanent value were the forte stops, which lifted the dampers, and secondly the soft stops which pressed the dampers onto the keys to stop the vibration, thirdly the full stop interposing soft cloth or leather between the picks and the strings; and fourthly shifting stops which shifted the entire key board--a movement later applied to the transposing keyboard. The harpsichord left for the piano maker three things: the wing form case, the use of two or three strings for one note, the forte piano pedal, and the shifting keyboard.[3]

[1]Dolge, Pianos and their Makers, 34, 35.

[2]Harper's Weekly, 50: 1395-1397.

[3]Dolge, Pianos and their Makers, 35-36, 38.

CHAPTER II

The Early Pianoforte and its Early and Later Foreign Makers

The construction of the early pianoforte may be described as follows: "The hammers are small wooden cubes like dice covered on top with buckskin and penetrated by the shanks of the hammers. All the hammers are placed above and independent of the key levers on a wooden frame. The lower end of the hammer shank is connected with a round disc by whose aid the hammer can play easily and by pressing the keys the hopper drives the hammer against the strings. Instead of the escapement of our newer pianos a string of brass wire permits the drop of the hopper to rest instantly after the stroke, and instead of the check added later, the hammer here falls upon cross threads of silk. A cloth covered damper rests on the strings not letting them vibrate freely until the string is depressed."[1] The thickest bass string of the first piano was thinner than the thinnest treble string of the modern instrument. There were several primitive actions: The English direct in which the hopper is pivoted on the keys or on a second lever raised by the keys; the Viennese action in which the key carries the hammer itself; and the repetition action of the Steinway, which is the Erard improved.[2]

[1] Weitzmann, History of Pianoforte Playing, 259.

[2] Fanny M. Smith, Noble Art, 67.

The invention of the piano as an entire and complete instrument must be credited to Christophori of Padua in 1707. In this first instrument he had skilfully worked out the idea of escapement of the hammers, after they had struck the strings which led to a rebound of the hammers. The silken cord interlocked crosswise to catch the hammer shank in its fall after striking was indisputably designed to facilitate repetitions. The hammer used by Christophori consisted of a small wooden block covered with soft leather. The compass of his piano was four and a half octaves.[1]

The second inventor according to date was Marius who in 1715 laid before the Royal Academy of Paris drawings of four clavichords the wooden hammers of which were substituted for the quilled jack.[2] No action was built according to his action because the hammer action to be effective required a different construction from that of the clavichord.

Almost contemporaneous with Marius was Schroeter who claimed to have made in 1717, in Dresden, an instrument without knowing anything at all of Christophori's instrument.[3] Simple and crude as Schroeter's action was it must be considered the fundamental of the German or Viennese action. His idea of having the hammer swing in a fork has been utilized in all later improvements of the so-called German actions. As early as 1724 pianofortes were made in Dresden containing the Schroeter action.[4] Four years later Silbermann of

[1]Dolge, Pianos and their Makers, 45-49, 80.

[2]Weitzman, History of Pianoforte Playing, 260.

[3]Spillane, History of the American Pianoforte, 18.

[4]Dolge, Pianos and their Makers, 42-43.

Saxony constructed pianos with this same action. However, he improved Schroeter's invention by doing away with the special escapement lever. He also extended the hammer butt beyond the axis, using the projections for the escapement lever. Silbermann came into the possession of a Christophori piano about 1747, and there is no doubt that he used both the Christophori and the Schroeter actions in his later instruments. Silbermann is most important in the history of the pianoforte for in him originated the two schools of piano construction--the German school and the English school.[1]

Pape, a Frenchman, was the first to introduce overstringing and iron bracing in the French pianos. Ignatz Pleyel and Henri Pape of Paris met with such notable results in this direction that they are to this day misnamed by most piano makers as the originators of the French action.

The later foreign makers may be classed according to nationality. John Andreas Stein acquired his training in the Silbermann work shops; later he made a name for himself with several inventions for the organ and the clavier. However, his most notable invention was that of a new hammer for the piano. In the Christophori pianoforte, the hammers were adjusted independently of the keys upon a wooden rail, while in Stein's German action, the hammers were set upon the keys themselves. Here the tail of the key is a metal pin bent backwards on which is fastened a brass catch, the bell-shaped shank of the hammer with its spindle fitting accurately into this cap. On depressing the key the butt of the hammer shank is caught in this spring catch which is adjusted behind the key which lifts

[1]Dolge, Pianos and their Makers, 45.

the hammer to strike the string and instantly lets it drop again into a position of repose. The check was so practicable that the player could govern the tones by a gentle or strong touch to the key. John B. Streicher, a grandson of Stein, used the final development of this action in a grand model of 1824. This action found much favor with the German makers, and musicians like Mozart and Beethoven. The outcome of the Stein or Streicher improvements was not so much the patents themselves, as that the action responded to the slightest effort of the player.[1]

The Erards were the most important of the later French inventors. They adopted the English or Backers actions for some time until they brought out their famous Erard grand action. It was in 1808 that Sebastian Erard was granted a patent for a repetition action for a grand piano in which he attempted to combine the elastic touch of the Vienna action with the forcefulness of the English action. But it is in a later patent, obtained by his nephew, Pierre Erard, for him in England, that the fame of the Erard grand piano lies.[2] The improvements instituted in their pianos between 1800 and 1808 were the following: their bearing for the strings; the case building schemes which were very significant; and the shifting transposition action of the grand. They are also accredited with first adopting and applying the string agraffe[3] by which a bearing down upon the strings was accomplished, thus preventing the very objectionable upward motion of the strings when they were

[1]Smith, Noble Art, 99.

[2]Dolge, Pianos and their Makers, 61.

[3]Spillane, History of the American Pianoforte, 26.

struck by the hammers and also improving the tone in the treble part. The idea of downward pressure on the strings near the wrest plank was followed by another invention, the "capo-tasto," in 1838, which is now used in varied forms in nearly all grand and upright pianos.[1]

Perhaps England was the most prolific in its inventors for the evolving piano. Among the earliest were Zumpe and Americus Backers, both pupils of Silbermann. The former, in 1776, made an unsuccessful attempt to simplify the Christophori action; the latter the same year invented an action in which the Christophori action was combined. Backers' action to this day remains the fundamental model for the English action in all its various modifications as illustrated in the Broadwood action of 1784.[2] The first Broadwood piano was completed in 1781. This epoch making invention revolutionized the construction of the square and gave an opportunity of increasing the volume of tone to an unexpected degree. So important was the invention that it was finally adopted by all makers, even by the Germans.[3] In 1802 Thomas Loud of London produced an upright piano which was the real precursor in build and general characteristics of the instrument of our times. His method of case building and the scale furnished the present parent upright out of which all the more improved instruments have descended. Wornum in 1826 produced a piccolo upright and patented his pizzicato pedal hopper and two check actions.

[1]Spillane, History of the American Pianoforte, 26.

[2]Dolge, Pianos and their Makers, 88.

[3]Ibid., 49.

Such in brief is the history of the pianoforte to about the time when the American makers attempted to improve its construction in one way or another. From this point the history of these foreign makers will be considered only occasionally as it has direct bearing on the American pianoforte development.

CHAPTER III

The Embryonic Period of the Development of the Construction of the American Pianoforte, 1742-1815

Before there were any very significant improvements, there was a period from 1742 to 1815 when a few makers occupied themselves with the making of a few spinets, harpsichords, or even crude pianofortes. Their part in the evolution of the American piano, is that they took the initiative in making pianofortes--crude as they were--here in America. Perhaps the instruments themselves were not so significant as the fact that there were taught in these promiscuous shops men who were later destined to revolutionize piano construction. This pioneer period begins with 1742 when a Swedish organ builder, named Hesselius, made spinets in Philadelphia.[1] During the following decade, Tremain of New York made a harpsichord of "a most agreeable and melodious volume and tone character," which was used in the old John Street theater in 1759 at a benefit arranged by a "company of London thespians just in town."[2] The first mention found concerning spinets made in Boston is a notice in the Boston Gazette of February, 1770 which mentions an "excellent spinet" that had just been finished by a resident of that city, "which for the goodness of workmanship and harmony of tone, is esteemed by the best judges to be superior to any that had been imported from

[1] Spillane, History of the American Pianoforte, 47-48.

[2] Ibid., 61.

Europe."[1] There were also New York pianofortes, probably imported in 1773 according to an issue of the New York Journal which reports a concert at which "the accompaniment of Mr. Hulett on the pianoforte was very chaste and always appropriate to the variations of Mr. Zedwitz's playing."[2]

The first pianoforte made on this continent was the work of John Behrent in 1775.[3] Ten years later George Uhloefer began manufacturing in New York, and in 1788 Charles Tawes, upon arriving in New York, went to Philadelphia and started making pianos in a modest way.[4] The next year Albrecht started up a rival shop. His instruments were copies with some improvements of pianos imported at this period from London.[5]

John I. Hawkins was not practically connected with the business until he appeared as a manufacturer of his special instrument in Philadelphia towards the end of 1790. Hawkins' American patents are all out of print, but luckily his father's are still extant and they explain all. "Now know ye that the said Isaac Hawkins do hereby declare that the said invention of improvements was communicated to me in confidence by my son John Isaac Hawkins residing in Philadelphia, North America, as described in the following." Hawkins included metallic elastic wire strings in his lists. These strings were supposed to be made of heavy links of wire formed like

[1]Spillane, History of the American Pianoforte, 47.

[2]Ibid., 62.

[3]Ibid., 72; Current Literature, 33:550 (November, 1902); Scientific American, 55:22822 (April 18, 1903).

[4]Spillane, History of the American Pianoforte, 77.

[5]Ibid.

a chain for use in the bass section. Hipkins described one of Hawkins instruments in possession of the Broadwoods as follows: "... One of the original pianos belongs to Messrs. Broadwoods. The strings descend nearly to the flooor, while the keyboard, a folding one, is raised to a convenient height between the floor and the upper extremity of the strings. Hawkins had an iron frame and a bracing of iron rods, within which the belly was entirely suspended, a system of tuning by mechanical screws and upper metal bridge, equal length of string throughout and metal supports to the action to which a later help to repetition was anticipated, the whole instrument being wholly independent of the outer case. Hawkins tried also a lately revived notion of coiled strings in the bass to do away with the tension. Lastly he sought for a sostenuto, which had often been tried." It must be remembered that Hawkins was a civil engineer and not a musician.[1]

In 1791, Benjamin Crehore exhibited a harpsichord, and the following year he founded at Milton, a suburb of Boston, a school where Osborne Lewis and Altheus Babcock were his pupils.[2]

The first patent issued at Washington in relation to piano construction was to J. Sylvanus McLean for "the alteration in scope and make of the pianoforte." The drawings and specifications for this invention were destroyed in 1836 and have never been replaced.[3] In 1800 Osborne Lewis, a pupil of Crehore, opened a shop in which Dwight, the Gilberts, and Jonas Chickering were employed. The same

[1]Spillane, History of the American Pianoforte, 80, 82, 83.

[2]Dolge, Pianos and their Makers, 271.

[3]Spillane, History of the American Pianoforte, 111.

year John Isaac Hawkins patented an upright piano which had vertical strings, full iron plate, and a check action. Hipkins says of this instrument: "It was a remarkable bundle of inventions but not a musical instrument."[1] This is the first invention anticipating our present upright, but of little account as regards utility.

Two years later, in 1802, Thomas Loud patented in England a diagonal upright pianoforte, which showed a distinct anticipation of overstringing. His specifications describe his inventions: "Upright pianos rendered portable by placing the strings in oblique direction, fixing the first bass string from the left hand corner to the right hand corner behind the sounding board and the rest of the strings in a parallel direction. By this means an instrument standing five feet high and four feet wide will admit of the bass strings being their full length, which is five feet and two inches.[2] This English invention is important for in 1830 Thomas Loud emigrated to New York and contributed greatly to the improvement of the American pianoforte.

The first patent granted to a resident of the state of Massachusetts was granted in 1804 to Francis Shaw for an improvement of the American pianoforte. Six years later the Babcocks began making pianofortes in Boston, and in 1815 John Osborn, the most talented of Crehore's pupils, started in business. It was from him that Jonas Chickering learned the art of piano making.

[1]Spillane, History of the American Pianoforte, 83.

[2]Ibid., 39.

The Baldwin Piano

Grand Soundboard
(top view) showing Acoustic Discs

(over)

From The Baldwin Piano Company, Catalog.

CHAPTER IV

The Soundboard: Its Structure and Development, 1822-1914

The development of the construction of the American piano has consisted of improvements for certain parts of the instrument, not for the instrument as a whole. For this reason the development of the soundboard will first be discussed, then the wooden and iron frame, the strings and method of stringing, and lastly the action.

The soundboard of a pianoforte is a surface capable of reinforcing the vibrations of the strings and at the same time sustaining its own independent system of vibrations. It is made up of the following parts: the board itself, the ribs, the bridge which supports the strings, the acoustic rim, and the acoustic disc.[1]

The board itself: Sound is propagated through different kinds of wood and in different directions through the same block of wood with differing velocities. The majority of piano makers agree that the board should be made of spruce; but each maker has to rely upon empyric experiments so as to construct a soundboard best adapted to his scale. This fact accounts for the interesting formulas for the best soundboard wood. Some of them are as follows: distinction is made as to the place of growth; spruce from cool, stony uplands is of finer grain than that from warm bottom lands; boards from the north side of the tree rather than those from the

[1]Smith, Noble Art, 72-73.

south side; the quartered wood should be cut so that the season rings run at right angles to the grain of the wood. In short, sounding board lumber should be selected with a view to its producing vibrations with a minimum expansion of power.[1]

The soundboard is built up of strips, three to four inches in width and running diagonally. In the Mathushek piano the strips are not more than an inch in width with the grain of the wood running perpendicularly to the face of the board. The Mathushek Piano Company claims that the tendency to warp out of shape is thus entirely neutralized.[2] The board is glued together in the rough to about half an inch in thickness, and is planed down to a finished thickness from about one quarter in the bass to three-eights of an inch in the treble.[3] The fine grained wood is better for the treble side, coarser for the bass, the space between being built up gradually so that unlike pieces do not come together.

The ribs: The sound board is strengthened on its back by a series of parallel pine ribs, which also serve to give the correct curve to the board.[4] This upward curve resists the downward pressure of the strings. Too many ribs stiffen the board and stop the vibration; too few allow it to play up and down and thus refuse the vibration of the strings. The ribs are placed at nearly equal distances apart, except in the last octave of the treble where they lie closer together.[5]

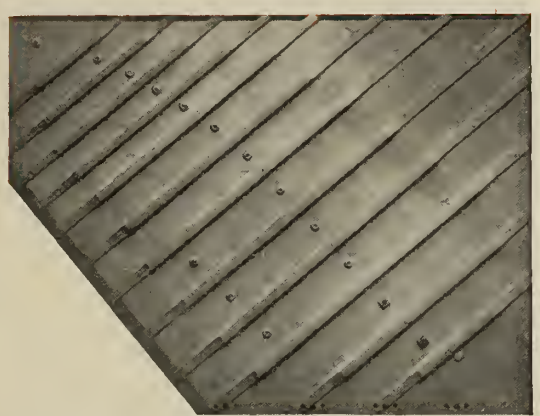
[1]Scientific American, 94:416-417 (May 22, 1906).

[2]Article on Mathushek piano in ibid., 95:217-218 (September 22, 1908).

[3]Ibid., 95:416-417 (May 22, 1906).

[4]Ibid.

[5]Dolge, Pianos and their Makers, 108-109.

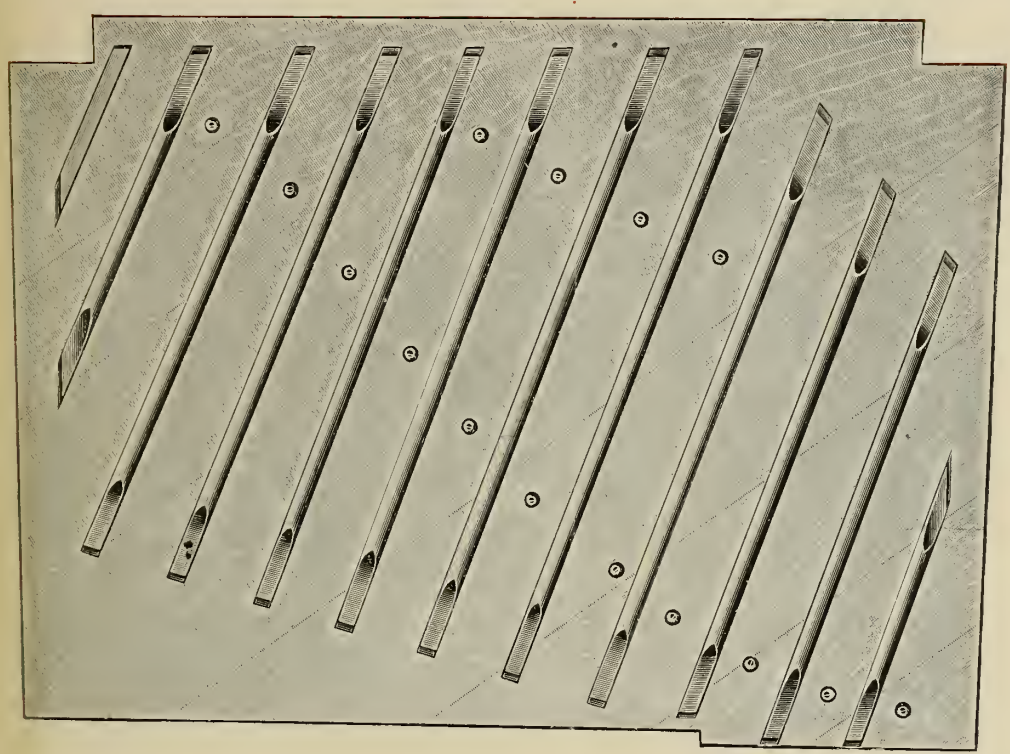


Soundboard, showing insertion of binding strips at the top and lower left-hand corner.

Laminated Acoustic Rim, built of many layers of thin wood

From The Baldwin Piano Company, Catalog.

9



REAR VIEW OF SOUNDING-BOARD, SHOWING MESSRS. GIBBONS & STONE'S SYSTEM OF CONSTRUCTION. THE RIBS ARE MADE OF LIGHT SPRUCE. THE BUTTONS SECURE THE BRIDGES ON THE OTHER SIDE (OR FRONT.)

Lowell

From Gibbons & Stone, Catalog.

The bridge: The bridge supports the strings and also serves to transmit the vibration of the strings to the soundboard. Measuring one inch by one and one-eight, it is made of alternating veneers of hard and soft wood, because such veneers are better conductors of sound waves than solid blocks of wood.[1] There are also solid maple or beech bridges in common use among the majority of makers. In the Baldwin piano there is a compound bent wood bridge made of strips of different woods glued and bent into proper form with a hard maple capping. This bridge favors the transmission of vibration from one end of the soundboard to the other. The bridge runs diagonally across the board. Since the fan scale has made its appearance, the bridge has been brought as much as possible to the center of the bridge.[2]

The acoustic rim: "The function of the acoustic rim is to form a conducting periphery for the reënforcing of tone whereby vibrations starting from one part of the soundboard are not dispersed but are taken up by the rim and redistributed to the entire board and to the vibratory system as a whole thereby enhancing the power and beauty of the tone.[3] The rim is built up of long layers of thin wood, glued and bent into shape. This rim is an endless polygon in form, and with the wooden frame supports the soundboard to which the edges are continuously glued."[4]

The acoustic disc: To the end that the ribs may be brought

[1] Smith, Noble Art, 74-75.

[2] Ibid., 75.

[3] Baldwin Piano Company, Catalog.

[4] Ibid.

more directly under the vibration of the strings, a disc of hard wood is set upon the soundboard at the intersection of each rib with the bridge. In this manner molecular vibrations are set up which are transmitted from the bridge to the ribs, the binding strips and the acoustic rim. This results in a more powerful and beautiful tone.

As far as could be ascertained, the first invention in regard to the soundboard was taken out by James Stewart on November 14, 1822, for an improvement in the arrangement of the same.[1] The next invention did not appear for thirty years, when in 1851, Cornelius Bogart patented an improvement in sounding boards. This was to some extent an anticipation of the patent of Driggs in 1855. The difference is that Bogart made the soundboard of several kinds of woods which were glued and fitted closely after the manner of the mandolin, and cut out so as to set in that formation naturally. Like a thousand other inventions of similar nature, Bogart's improvement amounted to nothing.[2] Spencer V. Driggs's invention, patented on December 18, 1856, number 13942, consisted of an arched sounding board held in position by a metalic frame,--ostensibly an application of the shape of the violin belly to the piano.[3]

Improvements were continually being made in the construction of the soundboard; among these was one made by Mathushek in connection with a linear soundboard bridge in 1865.[4] In 1866, William

[1]Spillane, History of the American Pianoforte, 84.

[2]Ibid., 136.

[3]Ibid., 225.

[4]Dolge, Pianos and their Makers, 52.

Weber was granted a patent for the invention of a resonator based upon the ingenious system of regulating the tension of the sound-board.[1] Three years later Steinway took out the first of his many patents concerning the sounding board. In this instance it concerned a ring bridge which obviated the use of two or more short bridges on the sound board for the covered bass strings, and supports all the strings of the instrument so that the molecular vibrations of any portion are carried from one end to another, entirely avoiding disagreeable breaks in the transition from the steel to the covered strings, so audible in pianos with separate bridges.[2] Nine years later, 1878, he patented a tone pulsator and a bent rim at the edge of the soundboard.[3] In 1880 his composite soundboard bridge was patented. This consisted of a series of alternating hard and soft layers of woods with a capping of hard wood by which the vibrations of the strings were propagated over a larger area of soundboard. Again in 1885 he took out a patent for what is known as the treble bell. The downward pressure of the strings upon the bridge of the sounding board is controlled by the treble bell which connects with the molecular vibration of the soundboard the subdivided pulses of the treble strings.[4] At about the same time, that is between 1878 and 1885, the Conover Brothers took out a patent for their "duplex bridge with auxiliary vibrators," which is adjusted at the end of the understrung and overstrung sections, accomplishing this result

[1] Spillane, History of the American Pianoforte, 219.

[2] Steinway and Sons, Catalog of 1885.

[3] Ibid.

[4] Ibid.

by qualifying and giving to the two sections a uniform quality.

The inventions of the twentieth century were opened with one by R. W. Gertz which is embodied in the Mason and Hamlin piano. It consists of an improved piano resonator built upon the principle that the loss of tone quality is due to the inability of the sounding board to retain its tension, for the tremendous strain of the strings on a modern piano has the tendency to force down the arch of the soundboard. By the use of the improved piano resonator, the soundboard retains its original convex form but bears greater pressure.[1] This patent was issued in 1902.

Perhaps not to be classed with soundboards, but as a tone reflector is the invention of Mrs. J. Mitchell Clark of New York, patented in 1904. Her tone reflector consists of a curved shell-like lid for the piano. These lids are far more graceful to the eye than the old flat style, especially the interior, which is constructed of strips of spruce running lengthwise to the grain and radiating in parabolic curves. This parabolic surface results in a remarkable resonance for it distributes the sound evenly in all directions. Richard Strauss was amazed at the result of the curved lid on the upright pianos and declared that it had gained the volume of tone equal to that of the grand.[2]

In 1906 Mathushek took out a special design of soundboard, the strips of which are but an inch wide; the makers claim that such a soundboard is assured against warping. In the sixteen years between 1898 and 1914, the Baldwin Piano Company have made the follow-

[1] Scientific American, 87:242 (October 11, 1902).

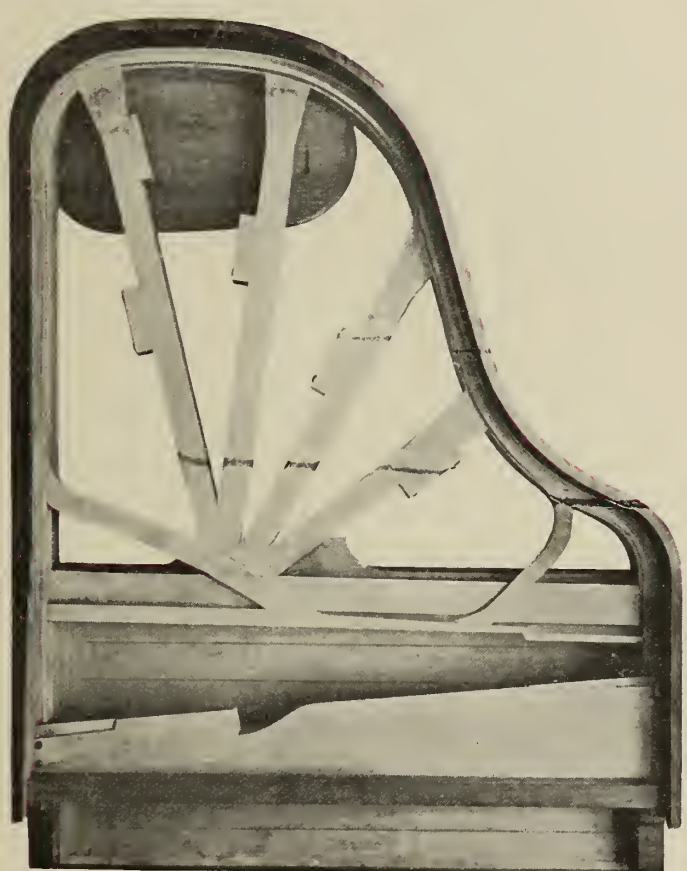
[2] Harper's Weekly, 48:1062-1063 (June 9, 1904).

ing improvements in their soundboard: the acoustic rim which redistributes the vibrations after they have been dispersed; the soundboard is provided with hard wood isolators; the acoustic disc which is inserted at the conjunction of the ribs and the soundboard bridge which connect the molecular vibrations of the strings with the bridge.[1] No date can be found for the MacPhail invention, which is a counterdraft on the case known as compensation rods.[2]

[1] Baldwin Piano Company, Catalog.

[2] The MacPhail Piano Company, Catalog.

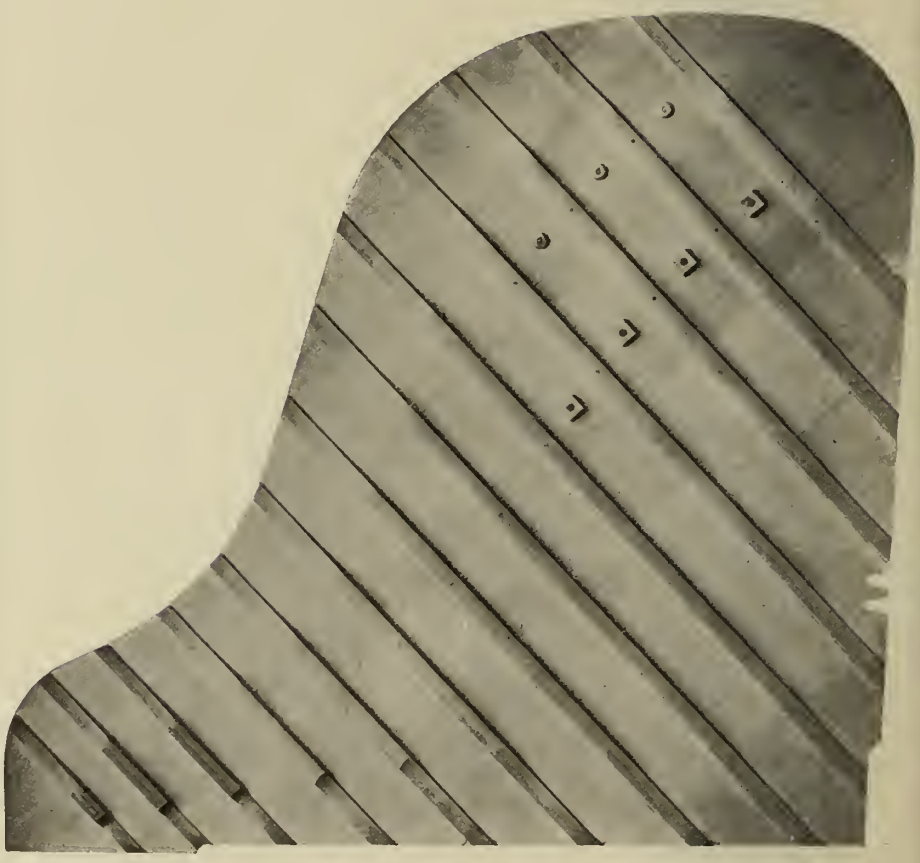
The Baldwin Piano



Construction of Grand Case
showing Acoustic Rim

(over)

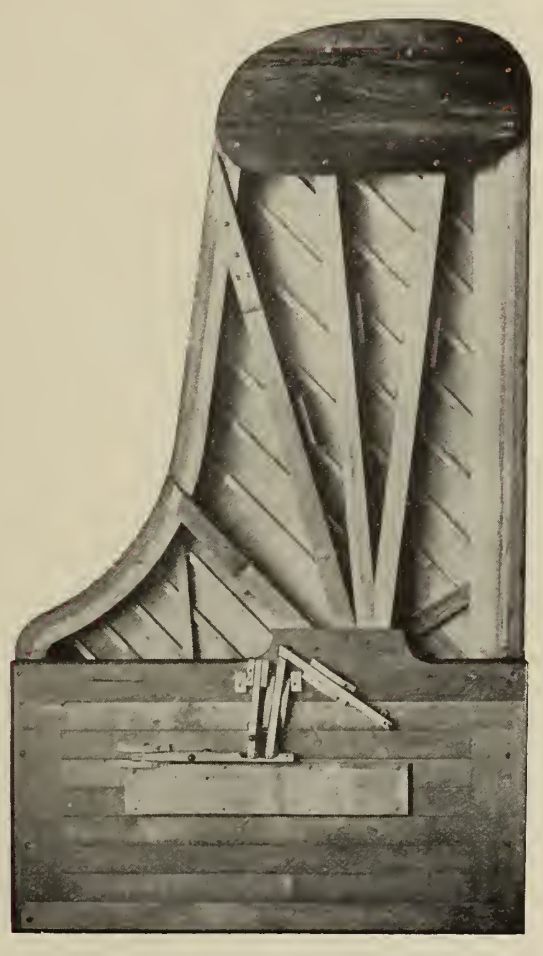
From The Baldwin Piano company, catalog.



Grand Soundboard
(bottom view) showing Ribs

From The Baldwin Piano company, catalog.

The Baldwin Piano

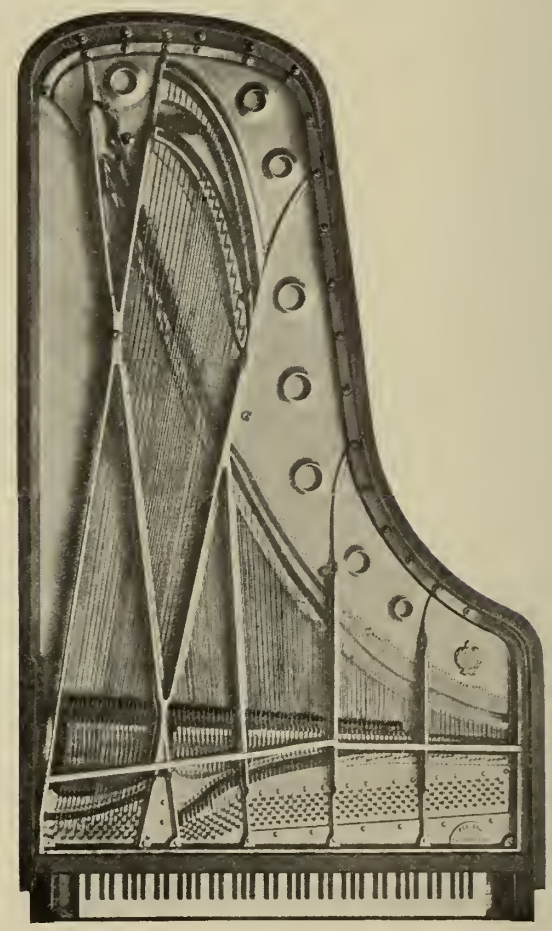


Under side of Concert Grand
showing Construction
and Bent-wood Case

Over

From The Baldwin Piano Company, catalog

The Baldwin Piano



Concert Grand Scale

CHAPTER V

The Wooden and Iron Frame

The massive wooden frame which forms the back of the upright piano, or the base and side of the grand, is the foundation to which the whole system is attached. It assists the metal frame in taking the strain of the strings and by its intimate connection with the sounding board aids in securing the required resonance qualities. The body of the piano is of quartered oak and the veneers are all glued on in double thicknesses, the grain of one layer running transversely to that of another. The resonant quality of the wood in the case and even the legs of a piano can have its share in the final tonal result.

The braces converge to one point against the beam which underlies the front of the soundboard where they are supported by each other and by the beam in combination with a metal screw which bears against the iron frame. Their otuer ends abutt against a rim of veneered wood which forms the inner case of the piano. This rim like the outer case consists of many veneers of wood pressed and glued into their required curves. Upon the rim is glued the sound board. Above the soundboard and bolted to the rim is the arched iron frame. Every precaution is taken to connect the vibrations of the wooden parts and to separate them from the iron.

The iron frame consists of the following parts: the plate itself; the wrest plank plate; the hitch pin plate; the transverse

bar; and the longitudinal bar. The iron plate answers the mechanical necessity which must be met in the effort to enlarge and qualify the tone of the piano. Above the sounding board and extending over the whole width and height of the rasp, including the pin block securely fastened down by the bolts and a set of screws, is what is known as the plate. It is a strongly ribbed, carefully designed casting made of a special iron alloy,which has to perform the function of carrying along its lower end the pins upon which the strings are strung and bracing at its upper end the principal block into which the tuning pins are driven.

The wrest plank plate is a block in which wrest or tuning pins are inserted. It is usually of beech, glued together, with the grain of each wood crossing at right angles to prevent splitting. There are as many holes bored out of the plank as there are tuning pins to drive in.

The hitch pin plate is that part of the iron frame to which the farther or lower end of the string is attached. In the upright piano, the plate lies at the base, right above the pedal bars. The hitch pin plate is strengthened by a transverse bar called the capo d'astro bar. This bar also has another function--that of providing the nodes of separation for the duplex scale.

The longitudinal bar is an iron tension bar running nearly parallel with the strings. Its function is to prevent the piano from collapsing endwise, for the tension of the strings is enormous, totalling about twenty tons.

The first improvements for pianos taken out in the United States were those concerning the wooden and iron frames. The first of these was in 1817 when John Geib was granted a patent for an improve-

ment in the "shape and structure of the upright pianoforte."[1] The following year Gutwaldt took out a patent in August for an improvement in the frame of the grand.[2] In 1821, Samuel Herve is credited with having invented the fixed spring plate, which Hipkins stated the Babcocks applied to the square with effective results.[3]

July 29, 1824, John Dwight, a pupil of Osborn, patented a "longitudinal metal bar,"[4] thus anticipating by sixteen months a minor feature of Babcock's metal plate for squares.[5] This iron plate of Babcock's patented in 1825, is incontrovertibly the basis of every subsequent attempt in that direction. He first practically introduced the principle of casting in one piece the iron hitch-pin plate together with that portion which supported the wrest plank. Babcock's plate was not a failure as was believed when applied. Moreover it was applied practically, not merely recorded in Washington.

Among the records relating to the pianos shown at the fourth annual exhibition of the Franklin Institute of Philadelphia in October, 1827, is the following reference to a Babcock instrument: "Especially mention is made of a horizontal piano by A. Babcock of Boston of an improved construction, the frame which supports the strings being of solid cast iron and strong enough to resist the enormous tension. This instrument was finished in the highest

[1] Spillane, History of the American Pianoforte, 105.

[2] Ibid., 107.

[3] Ibid., 42.

[4] Ibid., 56.

[5] Ibid., 89.

manner possible, not merely on the exterior but throughout, and the maker maintained the high character which he had previously acquired." The standard British authority, Mr. Hipkins, writing in 1880 on Allen's cast iron frame of 1831 writes as follows concerning Babcock: "Allen's proposal of cone casting had been anticipated in America by Alpheus Babcock of Boston, United States, who in 1825 patented a cast iron frame for the square piano. The object of this frame, like that of Allen's first patent, was compensation. It failed, but Babcock's single casting laid the foundation of a system of construction that has been largely and successfully developed in America ..."[1] Conrad Meyer of Philadelphia claimed that he invented the metal plate and a single casting in 1832; whether Meyer was aware of the previous efforts of Allen and Babcock or not, he has the merit of having made a good square piano on this plan of construction in 1833. It is interesting to know that Meyer never applied for a patent in 1832 or at any time in connection with the plate exhibited in 1876, and therefore was never granted one. More than that, there is no proof that the particular instrument exhibited by Meyer in 1833 at the Franklin Institute was similar to that shown in Philadelphia in 1876. If they were identical, then Babcock, who lived in Philadelphia in 1833, must have assisted Meyer to use his invention; this is by no means probable.[2]

Louis Fissore, A French piano maker who had worked in Pleyel's shop in Paris, arrived in Baltimore in the early part of 1833. He

[1] Spillane, History of the American Pianoforte, 120, 122.

[2] Ibid., 123.

took out a patent on July 22, 1833 for an improvement in metal plates. Fissore's patent appears in a condensed form in the Journal of the Franklin Institute for January, 1833. "The improvement here patented depends principally upon the employment of cast iron to constitute a part of the frame of the instrument. The novelty in this part not consisting in the use of the material, but in the particular manner of its construction and adaptation." The tuning pins are passed through a cast iron plate and are fixed in such a way as not to depend for their tightness upon being driven in, but upon a washer passing over a square shank at the back of the plate. The pin being drawn up to a shoulder by means of a nut screw, a particular kind of tuning hammer is employed, the key part of which is operated upon by pins and a powerful motion from the handle. Fissore's claims were for the originality of his manner of constructing and connecting the iron frame, and his manner of fixing the tuning pins and the instrument for tuning.[1]

In 1835, Thomas Loud of Philadelphia took out a patent for a cast metal plate with compensating tubes, after the manner of Thorn's and Allen's plate for grands previously patented in London, with the difference that Loud's tubes were supposed to rest in sockets cast in the frame which was produced in two entire castings unlike Babcock's plate. This frame was merely a strip of cast iron adjusted with small screws in the woodwork, outside the hitch pin section, and this is a copy of Babcock's scheme.[2] The following year, on May 12, Henry Hartyre took out a patent for an improvement

[1]Spillane, History of the American Pianoforte, 129.

[2]Ibid., 115.

in the English system of applying metal plates to a piano--carrying the tuning pin through the metal wrest plank underneath. This he claimed to have been original with him, but it can be traced back to 1800 when Isaac Hawkins carried his tuning pin in the metal wrest plank. Hartyre's application of iron to the wrest plank was an anticipation of its use today. The next year, 1837, Loud, imitated Hartyre by introducing a metal strip to be secured on a wrest plank.[1] In the Nunns and Clark pianos of 1838 a large compensating tube rests in the socket in the hitch pin plate, running end to end, skirting the lowest bass string and resting in another socket which is adjusted to the woodwork of the case. This became the generally accepted system of bracing until the metal plate was widely adopted.[2]

In 1840, Jonas Chickering patented his square metal plate together with an improved damper arrangement. This was a material improvement over Babcock's invention. Again three years later Chickering's plate for grand pianos was produced and patented. This plate was made in a solid casting, which was beyond question a significant improvement and a great stepping stone to the overstrung grand now used. It was immediately adopted by the Boston School in the construction of grand, square, and upright pianos. Chickering thus describes his invention of 1843 for the iron plate for the grand piano: "Patent No. 3238. Having thus set forth my improvement, I wish it understood that I am aware that the strings of a pianoforte, in their passage from the hitch-pins to the strain-

[1]Spillane, History of the American Pianoforte, 128.

[2]Ibid., 116.

ing screws, have been passed through the hold made through a pin screwed in a block, and from said pin bent or inclined upward to the straining screw, and therefore I do not claim such an improvement as mine. But, what I do claim consists in this improvement--that of supporting the strings by passing them through a solid ledge cast directly upon the lower part of the inclined front plate, through apertures of which ledge the strings are to be passed in the manner set forth; the tone being, particularly in the treble, greatly augmented and improved. I also claim my particular method of constructing the metallic frame of the grand pianoforte," etc.[1]

In 1850 Decker and Son Piano Company secured patents for a "composition metal frame," and an "improved pin block" arrangement.[2] Among the patents taken out the following year is one in relation to the Bacon and Raven piano, numbered 8320, which concerns an improved metal plate for squares, with a particular adjustment of the bridges that is very ingenious and indicative to some degree of the ability displayed by these makers throughout their useful career.[3]

Edwin Fobes in 1853 took out a patent for an improved vertical or upright grand of a peculiar kind in which there was a full metal plate reaching to the extreme top of the case, over which the strings were stretched. The wrest pins were driven down into the top of the case perpendicularly; the strings rested on rollers, and in tuning the angle was therefore avoided. Needless to say,

[1] Spillane, History of the American Pianoforte, 92-93.

[2] Ibid., 241.

[3] Ibid., 225-226.

Fobes' scheme attracted attention.[1]

The first notable piano exhibited by Steinway was a square entered in the American Institute exhibition of 1855. In this piano the American full metal plate covering the wrest plank was used--the connecting brace in the treble section and the wrest plank in one casting--but elevated above the strings and placed in such a manner as to admit of the improved scaling conditions. A better tone resulted while the capacity of the treble section of the plate to resist the "pull" of the strings was considerably enhanced. Bass overstringing was also introduced.[2]

The cast iron plate perfected by Jonas Chickering and others and the method of overstringing perfected and patented by Steinway in 1859 and 1862 constitute probably the most important contributions that the United States has made to the construction of the piano. Both of these improvements have been widely adopted in Europe as well as in the United States.

Steinway was issued a patent in 1866 covering the soundboard and double iron case. This important progress in the art of the manufacture is based upon the strength of material and also upon the new construction which united the downward angular projection of iron frame, overlapping and abutting against the wrest plank a capo d'astro bar. This bar runs parallel with the wrest plank above the strings and serves as a point of connection for all iron braces and on its underside in the treble has a bearing of chilled Steinway steel, forming the dividing point between the principal and

[1] Spillane, History of the American Pianoforte, 171.

[2] Ibid., 217.

the duplex scale. This system of connecting the metal frame with the sounding board and body produced the compression of the soundboard from its edge enabling it to respond to the faintest action of the strings, propagating the vibrations through the entire system and guaranteeing that the resonance of the instrument can never relax. The compression of the soundboard and the double iron case was patented June 5, 1866.[1]

Among the most remarkable inventions produced by George Steck was his independent iron frame for uprights and squares in 1870. In this invention was indicated the skill of utilizing iron in piano construction that he later displayed in his portable bijou uprights and grands.[2]

In the upright case construction of Steinway and Sons, patented May 28, 1872, great care was exercised to avoid certain angular projections cast upon the iron frame of the upright piano which serve to separate and isolate the resonating portion of the instrument from the front part, the latter consisting of ornamental case work, the key board, the pedal board, and action, all of which formerly exercised a considerable and rather disturbing influence upon the small sound board matter.[3]

The capo d'astro patented by Steinway in 1875 completed both stringing and metal framing and the patent for the action pilot in the same year marks the successful struggle to augment the energy of the action sufficiently to carry the heavy hammers.[4] Meyer

[1]Steinway and Sons, Catalog of 1886.

[2]Spillane, History of the American Pianoforte, 235.

[3]Steinway and Sons, Catalog of 1885.

[4]Smith, Noble Art, 120.

board. The adjustment of the latter medium tends to increase the effectiveness as a resonant agency and the tone is vastly improved.[1]

Prior to the advent of the cupola metal frame all frames were flat, level, and rested upon extra strips of wood interposed between the sound board edges and the iron frame. The Steinway cupola frame has its edges arched downward to the bent rim which supported the sounding board. This was patented in 1885.[2] In 1893 Gibbons and Stone patented a system to secure absolute resistance to the tension of the strings.[3]

T. J. Howard of Toronto, Canada (assigned patent to Newcomb Piano Company) has invented a series of tension members. The wrest plank and the bottom plank are supported by upright posts at each end and also by center posts mortised into the top and bottom plank; this in itself is an improvement on the old method of gluing end pieces. The cast iron plate acts in the usual manner to brace the wooden frame against the tension of the strings, whose lower ends are looped over the studs on the iron plate and whose upper ends are secured to pins driven in the wrest plank. The cast iron plate is secured to the pins by means of tie bolts which pass through the bottom and wrest plank. In this new construction, the usual heavy posts at the back of the piano are dispensed with, giving a more open and efficient soundboard. As the wooden frame is kept in shape by the tension rods, the soundboard will also retain its crown or convex form, thus preserving the tone of the piano. This patent

[1]Spillane, History of the American Pianoforte, 265.

[2]Steinway and Sons, Catalog of 1885.

[3]Gibbons and Stone, Catalog of 1893.

achieved great prominence in relation to the full iron plate in the piano which had some bearing on the later instrument. He exhibited a square with one of these plates at the Philadelphia Centennial Exhibition in 1876 which he claimed to have been the one made in 1832. He asserted that this was the first plate on the modern lines ever attempted in this country, therefore he claimed to be the inventor and the initiator of solid iron plates now in general adoption in grands, squares, and uprights.[1] There seems to be no proof to substantiate his claims, and since he never took out a patent for any of his "inventions" it is dubious if the honor should be his.

The capo d'astro bar in the upright of Steinway under which the duplex scale is applied was patented May 21, 1878. Parallel to the scale on the lower edge of the Steinway upright metal frame a projecting flange forms, in combination with the visible upper scale bearing, an effective body of resistance to the bearing and strain of the strings, so that the instruments remain in tune for a remarkably long period, unattainable in any of the older constructions and in combination with the duplex scaling resulting in that sonorous rich tone characteristic of the Steinway piano. The metal frame and the interior base frame were both patented on July 20, 1880.[2]

Patent number 247887, issued on October 4, 1881, to Chickering deals with the skeleton metal frame upon which the soundboard is supported, on isolated or distant points, along the edge. The iron plate is supported by the skeleton frame independent of the sound-

[1] Spillane, History of the American Pianoforte, 119.

[2] Steinway and Sons, Catalog of 1885.

was taken out a few years previous to 1907.[1]

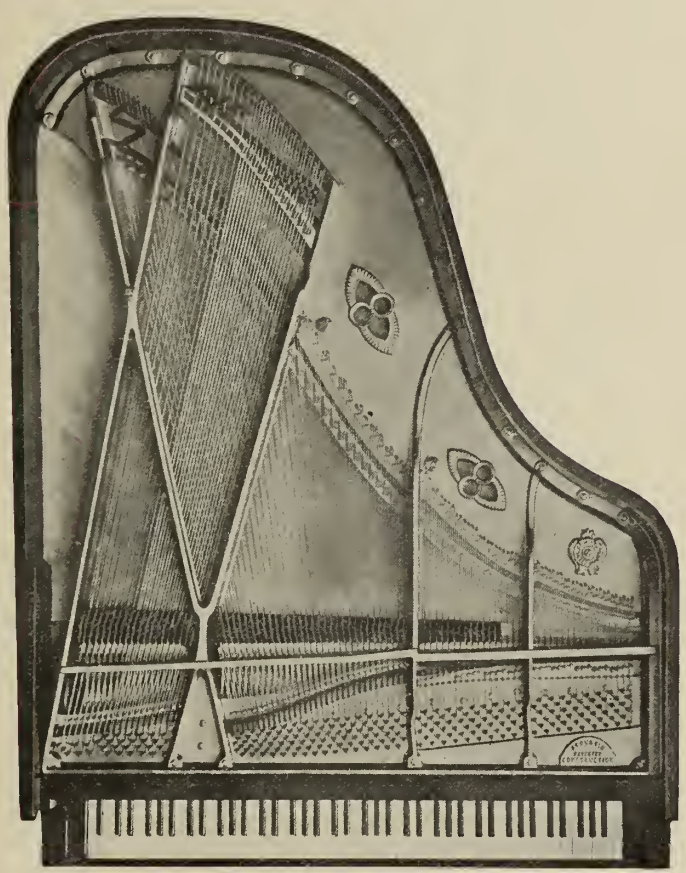
A method in the earlier pianos and the present cheaper pianos was to carry the plate at a reduced thickness over the face of the tuning block so as to allow the utmost bearing of the pins on the wood to be brought a little closer to the point of attachment of the strings. In this case, there is a tendency for the tuning pin to sag until it bears upon the lower edge of the thin iron covering. The Mathushek Piano Company realized that the only satisfactory way to take the combined pull of all the strings was to transmit it it as quickly as possible to a metal frame or plate of specially stiff construction. Therefore they designed the plate which was not only of extra thickness throughout but was also stiffened by deep ribs, so disposed as best to meet the heavy strain imposed. The plate was carried clear over the face of the block and its thickness at this face increased to about one inch. The holes are drilled directly through the plate and they are made sufficiently larger than the pins to allow the insertion of a bushing of hard maple. This bushing is driven into the hole of the plate with its grain transverse to the axis of the hole. When the holes are bored, they are made slightly smaller than the pins which are driven into them making an exceedingly tight fit. It will be found that the pull of the strings upon the tuning pins is applied at a point at which the pin bears upon the hard wood bushing in the plate. Consequently it is impossible for the pin to be bent down and the hard wood bushing, being confined to the metal plate, cannot crush but must hold the pin well up to its work. In the ordinary make of pianos, the

[1]Scientific American, 96:336 (April 20, 1907).

full plate and the tuning pin bushing are not used. The pin block has to be mounted upon a series of heavy vertical wooden posts which serve to keep the block in position when the strings are being tightened under the process of tuning. In the Mathushek piano there is no such thing as a pin block, its place being taken by the metal plate and the tuning pin bushing. This construction was patented in 1906.[1]

[1]Scientific American, 95:217-218 (September 22, 1906).

The Baldwin Piano



Parlor Grand Scale

(over)

From The Baldwin Piano Company, Catalog.

Under side of Parlor Grand
showing Construction
and Bent-wood Case

om The Baldwin Piano Company, Catalog.

CHAPTER VI

The Strings and the Methods of Stringing

The strings are the sound producing medium of the piano. In the treble steel is used, while in the bass, steel wires are covered with copper. The strings are attached at one end by the wrest pins to the wrest plank and at the other end by the hitch pins to the string block. The striking point of the string is about one-eighth or one-ninth of the entire length, even at the extreme treble. The total tension of the strings amounts to about twenty tons throughout the scale. The strings are divided into webs and arranged in the form of a fan, the bass strings crossing over the treble. The advantages of overstringing consist in the fact that the vibrations of the strings are better on account of their greater length and the vibration of the soundboard is more complete. The Mason and Hamlin Piano and Organ Company use the violin bow principle as the basis for their stringing and tuning.

The first patent taken out was also possibly more unique than any in succeeding years. It is a patent granted to Richard Bury of Albany on August 21, 1819, for a pianoforte with glass strings. In this instrument strips of glass were "adjusted, and placed in such a position as to be operated from a piano keyboard, the mechanism employed to strike the strings being on the cabinet-piano action principle, having hammers covered with a woolen felting substance so as to conduce towards the best quality of tone."[1]

[1]Spillane, History of the American Pianoforte, 139.

One of the best scales seen up to 1827 in New York was furnished Nunns and Fischer by Charles S. Sackmeister from whom they purchased it. Sackmeister started out in a revolutionary manner by placing number ten wire where number eight formerly was in the treble register, graduating the increased thickness down to the bottom string and placing his bridges in an entirely original range of distance from point to point so as to correspond with the stringing.[1]

In 1826 James Stewart was granted a patent for his method of stringing "without having loops or eyes in single strings, by making one continuous string pass round a single hitch pin." This principle was copied almost universally in a few years after the invention both in the United States and in Europe. Stewart had previously arrived in London from the United States where he was well known as the first partner of Jonas Chickering. The idea of stringing formulated in this patent of Stewart was carried over from Boston where it had been commonly known as early as 1820.[2]

Babcock took out a patent in 1830 for "cross strung pianofortes" together with an iron ring for hitching purposes which no doubt gave rise to the expression "Babcock's iron ring."[3] Thomas Loud built his piccolo uprights with bass overstringing as early as 1830, but Loud's application was very crude and was probably tested only in a few instances; however, such as they were they place him in a

[1] Spillane, History of the American Pianoforte, 151.

[2] Ibid., 42.

[3] Ibid., 123.

very conspicuous position in British-American piano history.[1] In 1833 Jardine made overstrung squares of this kind, "The bass strings crossing over the treble." Jardine's invention or rather use, coupled with Loud's venture give the credit of producing overstringing primarily to America, for the accomplishment antedates a similar attempt in Europe by two years.[2]

The New York school, 1835, was slow to follow the Boston school because they thought the full iron plate produced too metallic a tone. The majority of the New York makers leaned toward the German school, seeking quality of tone rather than volume. However, when in 1835 Steinway and Sons demonstrated that overstrung systems in combination with a solid frame would yield volume of tone with the desired muscial qualities,[3] the battle for the iron frame was won.

In 1836 Isaac Clark of Cincinnati was granted a patent of a general nature in which overstringing was included.[4] The same year J. Goodwin of London took out a patent for overstringing on March 8. According to this Babcock preceded him with his invention by six years (1836); nevertheless, Babcock's frame was not entirely acceptable from a modern point of view, but it is entitled to be regarded as an anticipation of the frame introduced by Chickering in 1837, for this was the complete link between the Steinway overstrung grand plate of 1859 and all preceding attempts prior to 1835.[5]

[1]Spillane, History of the American Pianoforte, 40; Smith, Noble Art, 57.

[2]Spillane, History of the American Pianoforte, 158.

[3]Dolge, Pianos and their Makers, 70.

[4]Spillane, History of the American Pianoforte, 40.

[5]Ibid., 40, 123.

Daniel Walker of the firm of Geib and Walker took out a patent on June 9, 1838 for a pianoforte wrest pin which was introduced into their instruments. This was an anticipation of the method of tightening strings similar to the screw method of tightening hairs in the violin bow now practiced by some piano makers. A strong belief in the mechanical screw process yet exists everywhere.[1]

In 1845 Jonas Chickering was granted a patent for an overstrung circular scale.[2]

The coating of the strings with gold had been anticipated in this country by H. J. Newton of New York in 1851; while the patent number 34640 was granted to Martin Miller in 1862 for a method of electroplating steel or other wire with gold, silver, and other metals.[3]

The circular scale in the squares which was undoubtedly the key to the improved method of the overstringing now in general adoption and was first introduced in 1845 by Jonas Chickering, was carried to a point of high development in 1854 by C. F. Chickering in two scales of which the piano makers speak as the best scale ever produced in the United States for pure tone results and uniformity of timbre. They were universally copied. Like many other scales they were not patented and for this reason it is impossible legally to protect scale and acoustic inventions of that abstract nature by patents.[4]

[1]Spillane, History of the American Pianoforte, 160.

[2]Smith, Noble Art, 57.

[3]Spillane, History of the American Pianoforte, 192.

[4]Ibid., 263.

On December 20, 1859, patent number 26532 was taken out by Steinway and Sons for an application of overstringing in grands, in conjunction with the special plate model which necessitated the radical departure in scaling and stringing conditions of such a nature as to excite wide attention and comment at the time among the old piano manufacturers. In the grand specified in the patent, the strings were adjusted and scaled so as to spread out in a fan shape from the hammer striking point down to the hitch pins.[1]

When the piano makers began to pay attention to the upright piano, which was about 1860, they adopted the now perfected system of overstrung scale on the whole iron plate. Patent number 121334 issued on November 29, 1871, to Chickering was a means of applying the circular scale to upright pianos. This was a very significant innovation. The object is reached, as in the square piano, by placing the hammers in a curved line, a corresponding arched form is given to the main rail in the frame and in addition an arched rail is used for damper action with special modifications indicated in the patent.[2]

A novel stringing system and action patent was granted in 1876 to Bosert and Schomacker for Colonel H. W. Gray's method of electrogold strings. This is regarded by the firm as their greatest speciality, because it is a remedy for the constant annoyance to manufacturers and performers, of iron or steel wires rusting and breaking in moist, hot, or changeable climates. Also it renders the tone or sound of any wire used for musical purposes of a

[1] Spillane, History of the American Pianoforte, 218.

[2] Ibid., 264.

superior quality.[1]

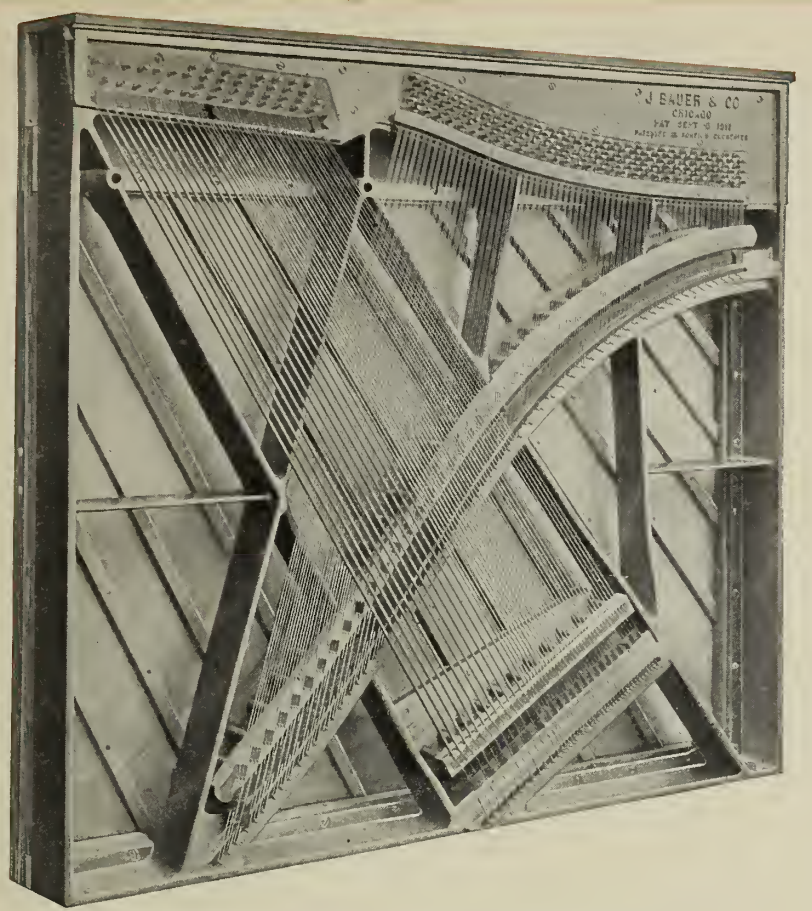
In 1879, Mathushek took out a patent for a method of stringing adjustment entitled the "equilbre system" of which he made a specialty in the construction of his uprights.[2] Steinway and Sons secured a patent in 1885 for a square piano having an overstrung scale and full iron plate designed on novel lines to conform with the varied and much increased strain of the new scale. The Steinways had entirely overcome the harsh metallic sound heard in other instruments having the full iron plate. The strings were grouped upon bridges in the form of a gradually expanding fan, permitting a much wider scaling and placing the thick strings of the lower notes obliquely to the blow of the hammer. The duplex scale, therefore, utilizes the proper use of the overtones.[3]

Sohmer and Company took out a patent on March 8, 1887, for "certain new and useful improvements in the pianofortes." These consist of the reverberation scale--a system of scaling or string adjustment where the auxiliary strings are arranged in conjunction with the regular strings for the purpose of giving forth reverberations or sympathetic waves of sound, thus augmenting the general tone results of each unison. The auxiliary string connected with each unison goes through a special hole in the agraffe and is tuned at the same time as the others. Meanwhile the regulation strings pass through the bearing holes in the agraffe lower down and thence to the tuning pins. This is applied principally from

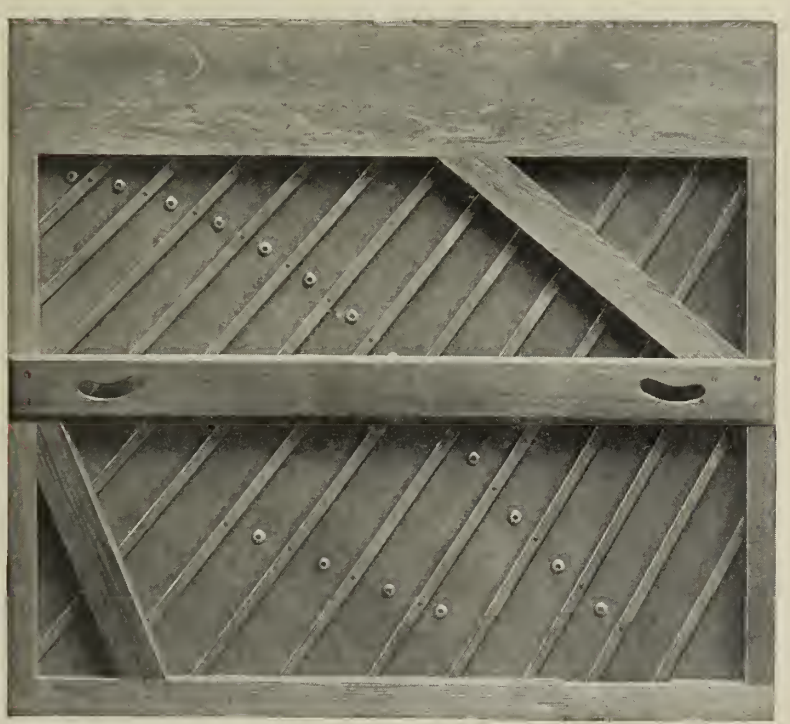
[1]Schomacker Piano Company, Catalog; Spillane, History of the American Pianoforte, 192.

[2]Ibid., 227.

[3]Steinway and Sons, Catalog of 1885.

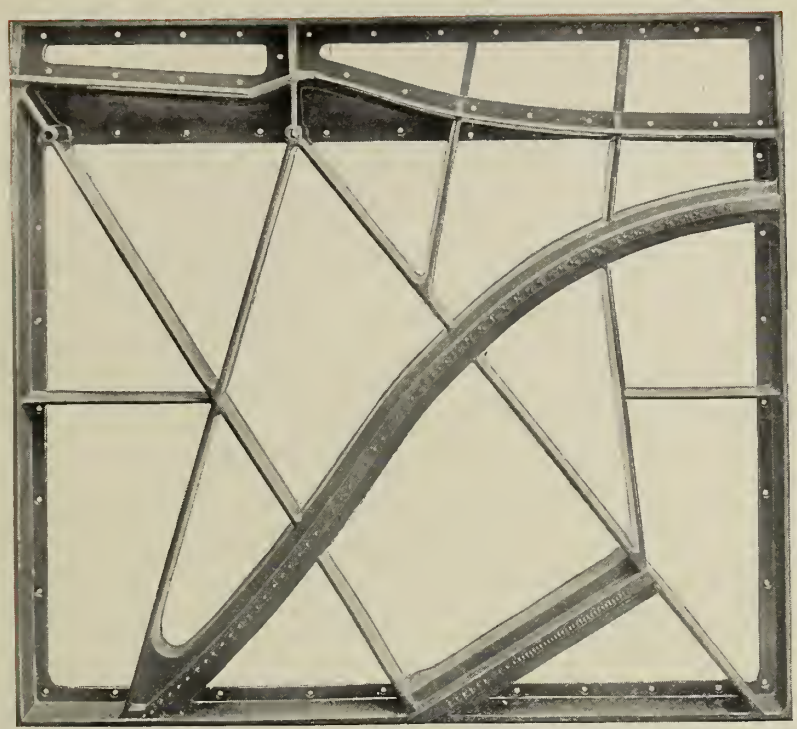


Front View of New Construction Frame.

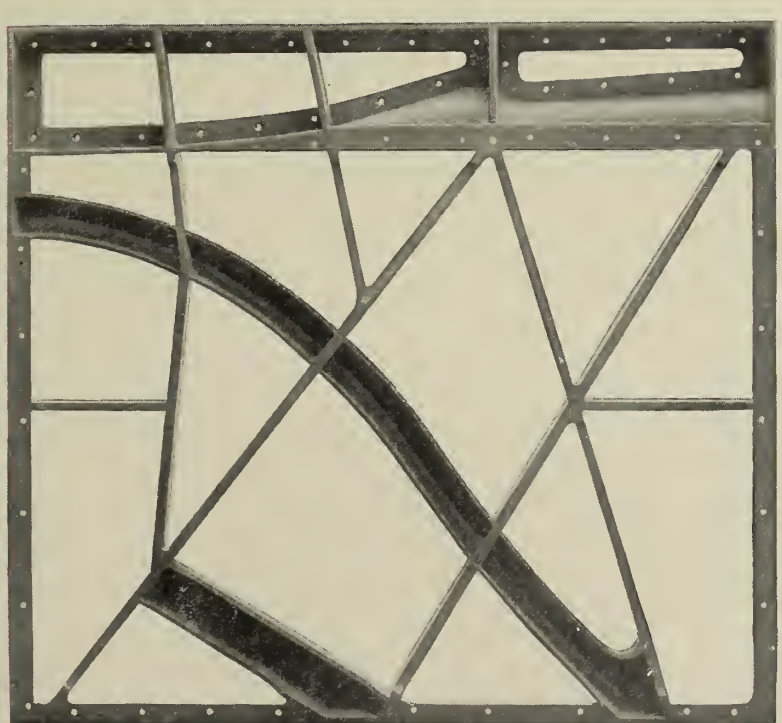


Back View of New Construction Frame Piano.

From "New method of piano construction" - Julius Bauer & Co.



Front View of String Frame or Plate.



Back View of String Frame or Plate.

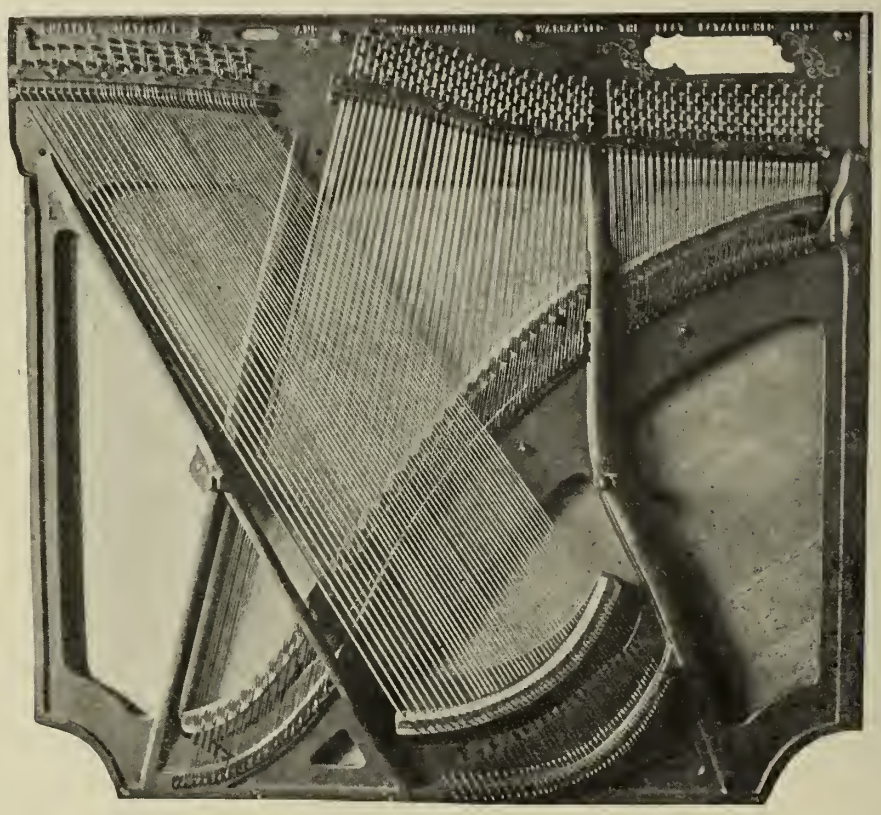
(over)

From "New Method of Piano Construction" - Julius Bauer & Co.

his part. It is in his bone and blood. It is as natural as his appetite and his desire to breath.

Mr. Bauer's early training all tended to make more fertile his genius in the field of piano acoustics. He was born in Chicago 44 years ago and, after graduation from a manual training school, he traveled in Europe. Returning he at once entered the piano factory founded by his father and there began the career that has placed him in the front rank among the masters of the science of tone building.

Mr. Bauer's invention, which has been patented in the United States, Canada, England, Germany, France and Russia, embraces a skeleton plate that is self sustaining, which is to say that the iron plate itself is of sufficient strength as to obviate the necessity for any dependence upon a wooden back or wooden posts for support. The ordinary method of piano construction requires a flat plate which is not, of itself, strong enough to carry the strain of the strings without the re-inforcement of the wooden back. Mr. Bauer claims an improvement in tone because of the fact that his open construction of the iron frame does away with all obstructions to the free vibration of the sound-board, these obstructions being the flat portions of the plate that cover the piano of the ordinary type on one side and the back and posts that cover it on the other.



Usual Piano Plate.

om "New Method of Piano Construction" - Julius Bauer & Co.

from the middle up to the extreme register.[1]

Behr Brothers and Company's patent for their "Stringing device" was patented on December 3, 1889: "The object of this invention is to obviate the objections stated to the present method of stringing pianos, and to remove the injurious pressure exerted by the strings on the sounding board. The invention consists in stringing the sounding board in such a manner that the strings of one tone are bent in one direction around the straining pins, while the adjoining strings are bent in the opposite direction around the straining pins, so that the two groups converge toward each other." Thus the instruments are relieved by this stringing process of all superfluous pressure and its fibres are allowed freer scope to vibrate, thus enhancing the power and quality of the tone generally This result is due to the fact that groups of strings, or a unison, act as a counterpoise to the other sections as shown.[2]

In 1910, Kranich and Bach patented their "violyn" plate, which is an adaptation of the principle of stringing the violin, that of slanting the neck so as to produce a natural bearing, thereby causing the string to lie firmly against the first notch of the finger board. The Kranich and Bach Company therefore cast their metal plate so that the part through which the tuning pins are inserted is inclined at an angle to the surface of the rest of the plate.[3] In 1914, William Bauer of Chicago took out a patent for stringing which included having the strings five and a half inches

[1]Spillane, History of the American Pianoforte, 227.

[2]Ibid.

[3]"The Violyn Plate," in Kranich and Bach Company, Catalog.

from the soundboard instead of one inch and a half, by having braces from three to three and a half inches deep. He has then strung the wires so that they are over a skeleton plate and all its braces. There are two bridges, one on the soundboard and glued to it, the other outside of the plate, and it is this latter bridge over which the strings are strung. The connection between the two bridges is by means of a series of maple dowels or tone posts of five eighths of an inch in diameter.[1]

The following improvements have no definite date, but the patents were taken out in recent years. There is one of Behning, Sr., concerning the "agraffe" which relates to a clever scheme of string adjustment by means of notches cut into the shoulder of the agraffe in which the string rests in a peculiar manner after passing through the bearing holes in front. The agraffe is screwed into the plate.[2] Finally there is the patent of the Conover Piano Company which consists of a hollow steel tuning pin. This pin is made to fit closely on a stud, the latter cast permanently in the plate. The pin has a slot on its side through which the string is carried, and when placed on the stud an unyielding and firm grip results.[3]

[1]H. Russell, New Method of Piano Construction invented by a Chicagoan.

[2]Spillane, History of the American Pianoforte, 247.

[3]Ibid., 280.

CHAPTER VII

The Hammers and Action

The key which is struck by the performer is pivoted at a certain point in its length and is arranged for transmitting motion from the finger of the performer through the action to the striking hammer. The action is so arranged that the hammer is not driven positively to the string but to a point that is a short distance from it, and the hammer passes over this distance by reason of the momentum already imparted to it by the action. The hammer after striking, rebounds therefrom and is caught by the back check and is prevented from further movement. When the key is released, the parts of the action immediately resume the correct position for giving another stroke.[1] Moreover, this position is taken when the key is only partially released, a full return of the key not being required before giving another stroke. With the striking mechanism for each key is associated a damper which nominally lies in contact with the strings, the same movement of the key that causes the hammer to strike its blow lifts the damper, closing it upon the strings when the player's finger is lifted from the key, unless it is prevented from so doing by the operation of the "loud" or sustaining pedal. Each key is pivoted at about its middle length upon a rounded saddle resting on the key frame.[2]

[1] Scientific American, 96:432-434 (May 26, 1906).

[2] Ibid.

In the upright piano the hammers strike their blows horizontally and the sound waves are thrown towards the sounding board. In the grand pianos the blow is delivered upwardly in a vertical plane and the tone waves are thrown away from the soundboard. The total weight, friction, and inertia of the action is overcome by the key lever with the aid of certain leads imbedded in one of the arms of the key lever and also by upbearing springs. The action lies upon a metal frame, the hollow tubes of which are filled with hard wood forced in under great pressure. Into these tubes the screw holes for the trains of action are securely bored.

The hammers are made with a round shank and head approximately pear shape in profile. The center of the head is a small wedge-shaped piece of hard wood around the point of which is glued a piece of underfelt which acts as a cushion for the thicker underfelt that does the striking.[1] The reason for the underfelt being harder is that it affects the great elastic rebound. The hammers must suit the scale and the build of the piano. "I once heard a Chickering," says Fannie M. Smith, "which had been fitted with a set of large, soft Steinway hammers. It sounded as if it had a cold in its head."[2] In the upright piano the hammers strike their blow horizontally and in some pianos obliquely.

On May 15, 1827, Thomas Loud, Jr., took out a patent for his down-striking action which was a very ingenious piece of mechanism and a remarkable development in action evolution for its time, but

[1] Scientific American, 94:432-434.

[2] Smith, Noble Art, 62.

it came to practically nothing.[1] Sackmeister patented a down-striking action on May 17, 1830, that won for him considerable notoriety.[2]

In 1824 Robert and William Nunns started in business initiating a radical change by introducing the present French action in their instruments, then in a rather imperfect state, and in fact anticipating in detail every very important improvement in the actions afterward patented by Erard in Paris. A member of the family, J. F. Nunns, was granted a patent for square action on May 5, 1831 which took in many of these improvements.[3] Ebenezer R. Currier of Boston took out a patent in the same year for a pianoforte "with a shifting action like the grand for horizontal instruments, also placing the keyboard midway so as to give a compass of seven octaves according to the stringing diagram and other models." Currier also patented a grand down striking action which is somewhat after the plan of Loud's square action of 1827. It is interesting to know that Currier was at this time also a partner of Gilbert who had formerly been a pupil of Osborne.[4] Loud and Brothers' grand made in 1825 had ninety keys--a fact that proves that seven octaves were known before 1845.[5] Conrad Meyer, mentioned previously in connection with the iron frame, exhibited a square piano in 1832 at the Franklin Institute. In referring to it in an addendum

[1] Spillane, History of the American Pianoforte, 115.

[2] Ibid., 152.

[3] Ibid., 150.

[4] Ibid., 96.

[5] Ibid., 95.

the committee said as follows: "We also think it worthy to notice a piano with an iron frame, which has some good qualities."[1] On December 7 of the same year Loud patented a further extension of the plate idea. In this same patent he published two square actions which were a compromise theoretically between the common English and French actions with special methods of adjusting the play of the jacks underneath the hammer wheels in each design. The action has neither hoppers nor rockers and the manner of regulating the escapement in each is original to a certain extent. The actions never survived, but Loud's compensating tubes were generally adopted in New York in 1838 and applied by various makers in such a manner as to defeat the object of Loud's patent.[2]

John Cutts Smith was granted a patent for a tuning key on November 14, 1838, which was probably the first contrivance to anticipate closely the present lever hammer. Before and after 1838 the wrest pins were manipulated by a T-hammer and Smith's invention on being introduced showed the disadvantages of the old methods.[3] The same year Edwin Brown, of the firm of Brown and Hallett, which began making pianos in 1835, patented a method of "damping" the strings of the piano so as to produce the effects made possible by a shifting action which limited the action of the hammer to strike one string as the instruments were then made. Added to this a harmonic effect was produced by Brown's contrivance that

[1] Spillane, History of the American Pianoforte, 119.

[2] Ibid., 115-116.

[3] Ibid., 165.

created much interest at the time.[1]

Timothy Gilbert and Company about 1841 were granted a patent for a number of ideas relating to uprights and squares worked out in one paper. The specifications anddrawings illustrate an entire upright action, an entire metal back and plate for the uprights designed to carry the soundboard independent of wooden connection and a number of lesser improvements that came to nothing. This outlined many ideas afterwards claimed by Wornum's tape-check action in England.[2] L. Gilbert in 1841 was granted a patent which was a modification of the English fly action. In this design there were neither under-hammers nor hoppers used, the jack setting in the hammer heel after the style of the present square piano. It is claimed that this action was used by Chickering and Sons, but this is not correct, for the square piano action used by the latter firm before 1860 or thereabouts contained the hopper.[3]

On January 27, 1843, Edwin Brown of Brown and Hallett patented a grand action of a very complicated nature, designed to insure a more perfect repetition and based on some principles of the French grand action later used by Chickering and Sons. That it was an advance is shown by the fact that it contained several minor points in which many action improvements of later years were anticipated.[4]

Wornum of London produced his celebrated tape check action in 1843 which was a very important contribution to the development of

[1] Spillane, History of the American Pianoforte, 166.

[2] Ibid., 90-91.

[3] Ibid., 90.

[4] Ibid., 166.

the piano. This action with some improvements added in this country has been for years universally adopted. Timothy Gilbert of Boston in 1841 brought out an action somewhat similar to Wornum's minus the tape check. This action of Gilbert's deserves special notice. It was furnished with a patent contrivance of value for assisting the quick return of the key as well as the novel check screwed to the "jack rocker" in the present way. Timothy Gilbert's square action resembles the old Chickering principle to a certain degree, but time has established the superiority of the ordinary French action beyond dispute at least over Gilbert's schemes.[1]

Hazelton Brothers were among the first piano manufacturers in New York to adopt the full iron plate and the enlarged square case of the Boston school in 1850. The addition of the French square rocker to these improved developments in case bracing and structure was the key to the subsequent character of the square piano of our day, and Hazelton must be credited with having been among the first to rise to the situation in New York.[2] In most houses the old English hopper and fly action were used and not until about 1850 was it generally discontinued in New York although various makers in Boston and Philadelphia used various modifications of the French rocker principle for regulating purposes applied in different combinations with the English, French, and special patent actions. The Chickerings and Gilberts continued to work upon a peculiar variation of the English action well known

[1]Spillane, History of the American Pianoforte, 37, 91.

[2]Ibid., 202.

to practical makers even now.[1] L. Gilbert made a number of improvements in this direction among which was an upright action with a method of projecting the whole hammer line in close proximity to the strings, after the manner of our present upright action. This action was patented as early as June, 1850.[2]

Among the patents granted in 1850 was one to Frederick Mathushek for a hammer covering machine. It was patterned after the Wilke machine, the frame being built of wood with ten iron screws, five each for a side, also having down pressure.[3] Another inventor of a hammer covering machine was Rudolph Kreuter of New York who patented a most ingenious but very complicated machine in the same year. Its main fault was that, because of the manifold attached springs and levers, it was impossible to use felt more than one-half an inch in thickness and the cry was for larger and heavier hammers. This machine has many of the elements of the present covering machine.[4] In 1851 Nunns and Clark purchased the hammer covering machine invention patented by Rudolph Kreuter for a trifle and thereby were the first to use the present improved method of hammer covering in the world. The discovery of this manner of hammer covering with the introduction of the felt, marks generally an era in the acoustic and musical development of the piano.[5] About 1863, Benjamin Collins, a piano maker of Boston,

[1]Spillane, History of the American Pianoforte, 151.

[2]Ibid., 90.

[3]Dolge, Pianos and their Makers, 100.

[4]Ibid., 99.

[5]Spillane, History of the American Pianoforte, 153.

came out with an improvement on the Kreuter machine. Kreuter's as well as Mathushek's machine was so constructed that the covered hammer had to stay in the machine until the glue had thoroughly hardened. Most makers increased the strength of the Mathushek machine which is generally adopted on account of the simplicity of the mechanism, but it is very difficult to produce the desired pointed hammer with the thicker felt required. Collins machine was too light in construction to make heavy hammers. In 1887, Alfred Dolge patented his machine which is in use in most of the prominent shops and factories today.[1]

After Gilbert's invention, Steinway followed with his "agraffe" adjustment for which a patent was secured on November 29, 1859, by which a more perfect bearing against the upward concussion of the hammers was devised. The patented tubular metallic action frame applied to all Steinway upright pianos was patented in 1868. Instead of the wooden bars which formerly supported the action and which were liable to warp and change under atmospheric conditions the Steinway action is sustained by brass tubes filled with wood which are of immense strength and cannot be injured or affected, being absolutely unchangeable. These tubes are hermetically sealed at each end and are soldered to metal hangers in upright pianos, the hangers being screwed directly to the wrest plank above resting in the concave ends of the metal posts below, which posts are screwed directly into the bed supporting the keyboard.[2]

The even scale of the Chickering of 1870 was a great achieve-

[1]Dolge, Pianos and their Makers, 100.

[2]Steinway and Sons, Catalog of 1885.

ment, for the considerations that governed the seven octaves of the piano vary much as the maker proceeds upwards; the struggle being first to obtain a clear pure bass and a full resonant treble; next to hide the places where the means adopted to produce one effect gave place to those necessary to gain for another. Thin as the volume may seem to us, this Chickering was enormous compared to its predecessors and the scale remarkably even from bottom to top. The patent covering this upright action was taken out on December 24, 1872.[1]

Through the invention of an effective and unchangeable tone sustaining or third pedal the beauty of the Steinway tone and its far greater duration of sound than of any other piano can be utilized. Whenever the performer desires prolongation of the sound of any note or group of notes the same must be struck immediately after, and upon raising the fingers from the keys the tone or chord will continue to sound as long as the foot continues to hold down the pedal and the vibration of the strings lasts, while all other notes can be played as well, as both hands remain at the disposal of the performer. This tone sustaining pedal was patented first on October 27, 1874.[2]

The action pilot, patented November 30, of the following year, disconnects the action from the keys, contrary to nearly all forms of repetitions thereby creating a much smoother escapement of the hammers and greatly facilitating the regulation of the touch while the broad cushioned surfaces of attack entirely prevent that knock-

[1]Steinway and Sons, Catalog of 1885.

[2]Ibid.

noise so prevalent in other pianos.[1] The patented constructions of the keyboard with the high key pins and actions of the Steinway upright piano permits the use of the long strings without necessitating the employment of "abstracts" as a medium of connection between keys and action, the latter working directly from the keys. This double keyboard was patented May 21, 1871.[2]

The Steinway and Sons grand piano action embraced two patented improvements. The old system of securing the hammer butts upon the wooden frame had the great fault that, even after the most careful selection and preparation could not prevent their warping and changing under atmospheric influences, nor a certain disagreeable knocking noise when trembling under a powerful touch. Steinway constructed a frame of metal standard and metal tubes filled with hard wood into which the screw holes for securing the trains of action are bored upon a scale machine so that all the actions of each respective style are mathematically alike and can be changed from one instrument to another with the greatest facility even by non-experts. The construction of these frames guarantees the most rigid and most unchangeable basis for the action parts. The tubular action and metal standards for grand pianos were patented December 20, 1879.[3]

Another invention taken out by Steinway is that for regulating the striking distance. The entire mechanism of the keys and the action can be moved front or back by a patented device in such a

[1] Steinway and Sons, Catalog of 1885.

[2] Ibid.

[3] Ibid.

manner that the striking point of the hammers upon the strings can be regulated with the greatest nicety so as to obtain the best quality of tone.[1] The depth of touch can also be regulated accurately by a patented device taken out on July 22, 1879 which was applied to all grand pianos, so that any change in touch resulting from dampness or otherwise can be remedied with the greatest ease.[2] The liability of piano felt hammers to swell and change or become unglued under atmospheric influences is averted in all Steinway pianos by a wire fastening and especially by chemical preparations applied to the hammers at the point of elasticity, concentrating the latter upon that portion of the hammer which strikes the strings, thereby permitting of tone effects in light and shade unattainable in pianos of older systems or constructions besides insuring an unequaled durability of the hammer. The humid-proof hammers were patented August 24, 1880.[3]

The key frame of the old pianos, both grands and uprights, consisted of a wooden frame filled in with thin panels of wood resulting in the two great faults, that under a strong touch the thin panels would emit a drumming noise, and that such frame beds were very liable to get out of their proper level position through atmospheric or other influences. The key frame bed patented in 1880 by Steinway and Sons consists of a series of strong frame pieces with layers of felt between the said pieces which leave room for swelling and shrinking, completely neutralize and obviate the drum-

[1] Steinway and Sons, Catalog of 1885.

[2] Ibid.

[3] Ibid.

ming noise referred to in constitution an unchangeable bed for the mechanism.[1] A further patented improvement of 1880 in the upright piano is the repetition action with double cushioned hammer butts which is applied to all Steinway pianos.[2]

Behr Brothers in 1881 patented their hammer compensating lever in grand action which was the first produced. This is one of the noteworthy improvements in grand piano actions. Power and prompt repetition combined with the least possible expenditure of force at the finger tips is considered the desideratum in a piano action and keyboard. The greatest difficulty in securing lightness of touch is the weight of the hammers which the jacks lift up to throw against the strings; diminish the weight of the hammers by cutting them down, and the power of the blow is sacrificed. Now without diminishing the power of the hammers by trimming down the heads or resorting to any other expedient, Behr Brothers have secured the desired touch. To quote the specifications: "This invention is designed to overcome the defects mentioned by counter balancing the weight of the hammer heads by means of a balancing device applied to the hammer butt, and the invention consists of a grand piano action in which the butt of the hammer is executed beyond the pivot and provided with an enlarged eye filled with lead for counterbalancing the felt head, whereby the heaviest bass hammer can now be operated just as easily as the light hammers in the treble." Of course the counterweight is graduated from end to end, so as to offset the weight of the hammer from the front.[3]

[1]Steinway and Sons, Catalog of 1885.

[2]Ibid.

[3]Spillane, History of the American Pianoforte, 272.

Another invention of 1885 is P. G. Mehlin and Sons of a grand scale plate together with his harmonic scale and touch regulator. The grand scale plate is a very clvere innovation in upright piano development in a composite sense, necessarily, because Mr. Mehlin's system of plate structure and general scaling conditions cover a wide territory in mechanics and acoustics. This grand plate scale is intended to give the upright to which it is applied all the characteristics of a horizontal grand, with the advantage of being of a more convenient size. Mr. Mehlin's harmonic scale has an auxiliary fourth string to each three-string unison, damped separately by an ingenious damper action. This string passes over the bridge in the usual manner and then through an agraffe fixed rigidly in the sounding board and secured behind by means of a screwed nut. The agraffe is so adjusted as to bear down upon the center of the string thus dividing its vibratory surface into two halves, so that, for instance, the same length of string tightened to the exact tension of the regular strings in the same group would produce two tones, an octave each above the former. This fourth string is intended for harmonic reverberations, each giving forth sound waves in unison with the string to which it is affixed. The increase in the power and sustenuto possibilities of the piano is therefore considerably enhanced. This additional string moreover has a tendency to brace the sounding board and thus act as a counter poise to the pressure of the other strings on the bridge. The utilitarian value of Mr. Mehlin's touch regulator is incalculable to tuners and regulators, being a simple devise for regulating the position of the key frame independent of the sinking of the keyboard so as to attain the correct touch without resorting to the

usual expedients which consume much time.[1]

The Sohmer pianissimo pedal patented February 8, 1887 is an improved attachment for producing refined and artistic piano effects, in their instrument, and as used in combination with the ordinary soft pedal. By an ingenious trapwork and action arrangement the hammer line in uprights can be projected to any range of distance from the strings without a diminution of touch control in the front.[2]

In 1893 John Ammon, a New York piano maker obtained a patent for the process of gluing a strip of tapered hammer felt together and then inserting the same into a wooden hammer head having two prongs at the top. Ammon's motive was to economise on felt and it does require much less felt around the moulding, but the hammer is utterly impracticable because it is impossible to economise in the treble hammers sufficiently to produce a satisfactory tone.[3]

Kranich and Bach patented their isotonic pedal on July 9, 1907. One of the problems that the piano makers have to solve is to subdue the tone without interfering with the touch. The method now in use in every piano except that of Kranich and Bach is to shift the entire action by pressing down the soft pedal. This solution is open to serious objection besides not really accomplishing the desired purpose. The soft pedal absolutely destroys the evenness of the scale and does not subdue the bass notes, but allows them to predominate over the partially and unequally subdued tenor and

[1]Spillane, History of the American Pianoforte, 296.

[2]Ibid., 257.

[3]Dolge, Pianos and their Makers, 102.

treble. Furthermore the shifting of the action frame brings the hammers and the strings in contact at an unaccumstomed place where the grooves have not been formed. By simply raising the entire row of hammers closer to the strings, the throw of the hammers is shortened, and with subdued tone, with entire and absolute purity of tone throughout the scale.[1]

Another patent taken out by Kranich and Bach is a brass spiral shaped spring used as a washer. With every screw entering into the construction of all actions in grand and upright pianos, it can be readily seen that this spring will always regulate the pressure of the screw head on the wooden parts which it is intended to keep in place, irrespective of atmospheric changes and "any tuner will testify to the fact that it is never or seldom necessary to screw up the Kranich and Bach action."[2]

The brass sticker socket is a small brass cup screwed into the top of each key about one inch from the rear end, into which the cup the lower end of the connecting rod between the key and the action by simply lifting the sticker out of the cup without the use of any tool whatsoever.[3]

In Kranich and Bach pianos, by the use of their metallic action rack, the action proper is absolutely independent of the case and cannot be affected by any damage to the latter. It consists of a small brass flange similar to an ordinary hinge when nearly closed, through the loop of which the wire of the damper

[1]Kranich and Bach, Catalog.

[2]Ibid.

[3]Ibid.

passes. A small screw passes through the center of the flaps of the flange, thence through the wooden damper bloack and then fits into a small nut. By drawing the screw tight the flaps of the flange are pressed together, clasping the damper wire firmly and also tightening the damper block to the flange. It can easily be seen that the parts being of metal no atmospheric change can affect the position and rigidity of the damper block.[1]

Of the patents taken out within the last few years is an improvement embodied in the Conover upright action. To use Conover's language: "The improvement consists in removing from the customary French action the slender tapes and wires to which they are attached and substituting for their use a permanent metal hook centered in the top of the jack, which catches in the slot of the butt and keeps the jack in close proximity to the knuckles, modifying the touch and adding durability to the action."[2]

Having traced the history of the construction of the pianoforte in American it is realized that from an insignificant embryo and through long decades of constant fostering the piano has become the universal instrument of today. The whole knowledge of musical instruments has been embodied, either in construction or in ideal. Violin, harp, harpsichord, and organ have each contributed something; every phase of our civilization, and every nation which brought civilization forward, has lent a hand. It seems that the piano of the present day is perfect; but probably after another

[1]Kranich and Bach, catalog.

[2]Spillane, History of the American Pianoforte, 281.

five centuries growth, posterity will speak in terms of wonder and amusement of the little tinkling instruments made in the twentieth century.

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Julius Bauer and Company, Inc., Chicago

Boardman and Gray, Albany

The Cable Company, which handles the following pianos:

the Conover piano
the Kingsbury piano
the Cable piano
the Mason and Hamlin

Chickering and Sons, Boston

Chickering Brothers, Chicago

The Emerson Piano, Boston

J. & C. Fischer, New York

Gibbons and Stone, Rochester

Hallet and Davis, Boston

Hardman, Peck and Company, New York

Hazelton Brothers, New York

W. W. Kimball Company, Chicago

William Knabe and Company, Baltimore

Krakauer Brothers, New York

Kranich and Bach, New York

Lyon and Healy, Chicago

Mason and Hamlin, Boston

A. M. McPhail Piano Company, Boston

Paul G. Mehlin and Sons, New York

Henry F. Miller and Sons Piano Company, Boston

Schomacher Piano Company, Philadelphia

Schaff Brothers, Huntington, Indiana

Steger and Sons, Chicago

Steinway and Sons, New York

Charles M. Steiff, Baltimore

Rudolph Wurtlizer Company, Chicago

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